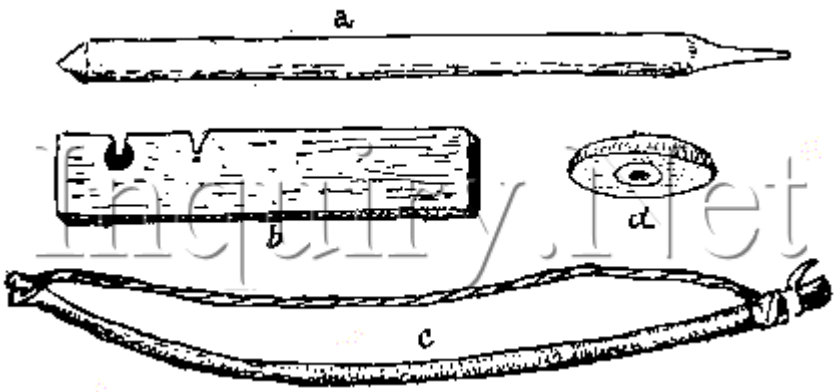
# Fire: Rubbing-Stick

by Ernest Thompson Seton

I have certainly made a thousand fires with rubbing sticks, and I have made at least five hundred different experiments. So far as I can learn, my own record of thirty-one seconds from taking the sticks to having the fire ablaze is the world's record (this was written in 1907; since then the record has been repeatedly lowered by others), and I can safely promise this: That every man who will follow the instructions I now give will *certainly succeed* in making a rubbing-stick fire.

Take a piece of dry, sound, balsam-fir wood (or else yucca, cedar, cypress, tamarack, basswood, or cottonwood, in order of choice) and make of it a drill and a block, thus:




***The drill*** should be not more than five eighths of an inch in diameter and 12 to 15 inches long. The larger your drill, the harder you have to work. There is no use in having an immense pile of powder to get a spark. If the drill averages five eighths of an inch in diameter, is perfectly straight, and tapers off at the top nicely, it will revolve smoothly and bring your spark quickly. The drill should be held perpendicularly and should be held solidly by the hand resting firmly against the shin bone. The drill should be placed in the bow so that the loop is on the outside of the thong away from the bow. This prevents the drill from rubbing against the bow.

***Block, or board,*** two inches wide, six or eight inches long, five eighths of an inch thick. In this block, near one end, cut a side notch one half an inch deep, and near its end half an inch from the edge make a little hollow or pit in the top of the block, as in the above illustration (cut 1 b).

The notch should be cut into the board deeper at the bottom than at the top, and wider from a side view at the bottom than at the top. The narrower the notch is, while allowing the powder to drop, the better. The notch should be so cut that when the hole has been drilled, there will be just a little slit running from the side to the center of the hole through which the powder drops down. The wood must be cut smooth, or the spark may stick and not drop below. I have found it best to have the notch face me rather than have it the other side of the board away from me. I have noticed that the average person leans his drill, which causes it to push against the outside rim of the hole and to break the side away. Usually it is better to start your hole above the notch and then open up the notch until it connects with the hole.

***Tinder.*** For tinder use a wad of fine, soft, very dry, dead grass mixed with shredded cedar bark, birch bark, or even cedar wood scraped into a soft mass.

A meadow mouse's nest does very well for tinder. It is easy to get a number of them after the snow has gone from the wet meadows in spring time.

***Bow.*** Make a bow of any bent stick two feet long, with a strong buckskin or belt-lacing thong on it (cut 1c).

***Socket.*** Finally, you need a socket. This simple little thing is made in many different ways. Sometimes I use a pine or hemlock knot with a pit one quarter inch deep, made by boring with the knife point. But it is a great help to have a good one made of a piece of smooth, hard stone or marble, set in wood; the stone or marble having in it a smooth, round pit three-eighths inch wide and three-eighths inch deep. The one I use most was made by the Eskimo. A view of the under side is shown in cut 1 (fig. d).

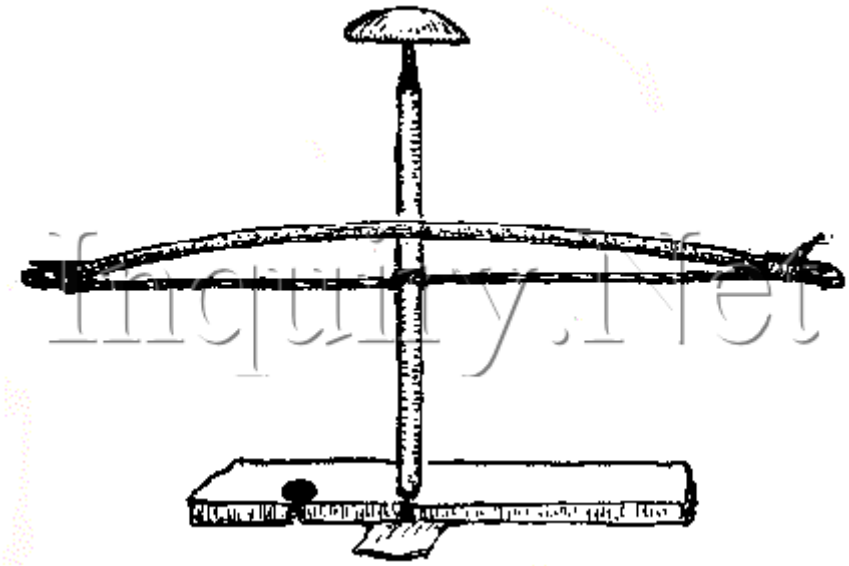
The hole in the soapstone should be large enough and deep enough to hold the upper point of the drill solidly without slipping out. The socket itself should not be held in the fingers but in the palm of the hand. Never let a light muscle do what a heavy muscle can do. There is a very general tendency to let the wrist get away from the shin bone, which leaves the hand wobbling, unsupported in the air.

***The Foot.*** The foot is placed close to the drill, with all the weight on the ball of the foot, the heel off the floor so that you can regulate the pressure by the raising and lowering of the heel.

Now we are ready to make the fire:

Under the notch in the fire-block set a thin chip.

Turn the leather thong of the bow once around the drill: the thong should now be quite tight. Put one point of the drill into the pit of the block, and on the upper end put the socket, which is held in the left hand, with the top of the drill in the hole of the stone (as in cut 2). Hold the left wrist against the left shin, and the left foot on the fire-block. Now, draw the right hand back and forth steadily on level and the *full length* of the bow. This causes the drill to twirl in the pit. Soon it bores in, grinding out powder, which presently begins to smoke. When there is a great volume of smoke from a growing pile of black powder, you know that you have the spark. Cautiously lift the block, leaving the smoking powder on the chip. Fan this with your hand till the live coal appears. Now, put a wad of the tinder gently on the spark; raise the chip to a convenient height, and blow till it bursts into flame.



N. B. *The notch roust reach the middle of the fire-pit.*

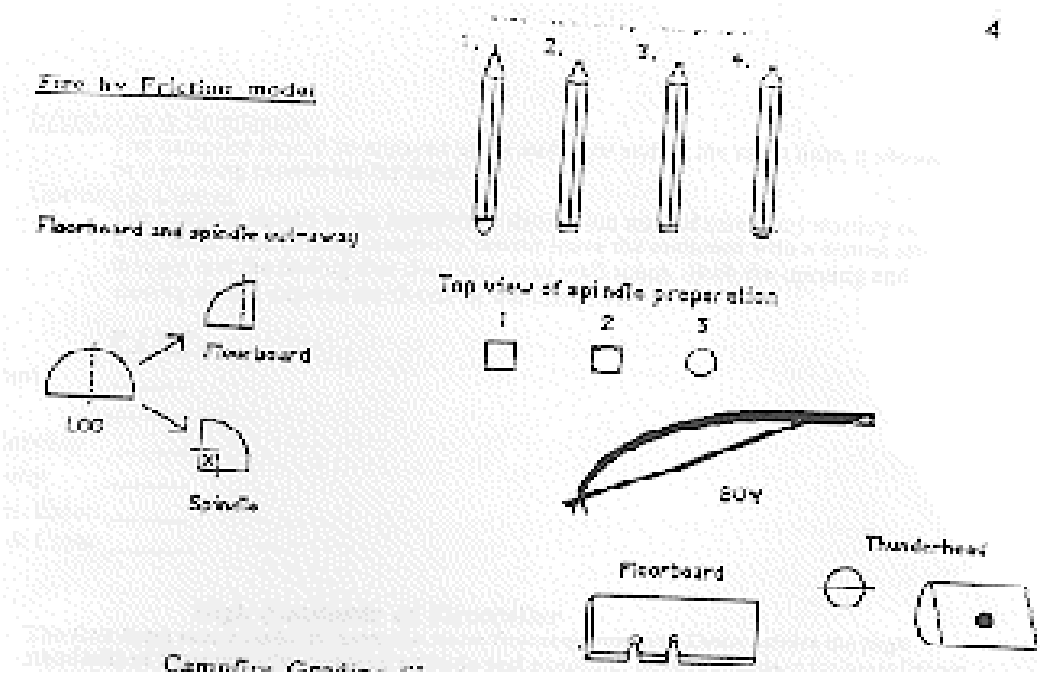
You must hold the *drill steadily* upright, and cannot do so without bracing the left wrist against the left shin, and having the block on a firm foundation.

You must begin lightly and slowly, pressing heavily *and sawing fast after there is smoke*.

***The Spark.*** When you get your spark, hold your left hand on the board as you take your foot off, and tap with the right hand (to loosen any spark that might hang onto the notch) before lifting the board. When you put your tinder on the spark, hold it down in the back and on the sides so that you will not blow the spark away.

*If the fire does not come, it is because you have not followed these instructions.*

One of the requirements for the rank of Firecrafter is that the candidate start a fire using the fire-by-friction method. The following information is reprinted from the *Firecrafter Candidates Manual*.




Do you think that you can build a fire using a fire by friction set made by yourself? If you answered YES to the above question, you are already 50% done with the building of your fire by friction. It is a fun challenge to any scout and the following tips should make it easier for you, especially if you believe you can build a fire by friction set. The first step is to find the wood for your spindle and fireboard. This wood can be obtained from the Firecrafter area in Scoutcraft. These two parts of your set should be made out of the same type of wood. If for some reason your spindle and floorboard are not made of the same type of wood, make sure that the spindle is a harder wood. Red Elm (Slippery Elm), Cedar, Basswood, Walnut, Blue Beech, and Cottonwood are all good to use for your set. Your wood must be bone dry, otherwise it will not work. If your wood is not completely dry, don't worry, it can be dried in a number of ways. If the weather is good, have an adult in your troop place the spindle and floorboard on the dash board of their vehicle for a day (it must be in the sun). Also, if you wrap the set in aluminum foil, you can place it on a charcoal fire for a while to dry it (be careful not to burn it).

The spindle should be straight wood and preferably from the center of the log. A good height for your spindle is to make it as long as your lower leg, while the diameter should be around .75". With a sharp hand axe, shave the corners down, so as to make your spindle eight sided. Leave the edges sharp, so that they will bite into the thong or rope. Sharpen both ends, with the top end being a little more pointed than the bottom end.

Next, split a piece of wood about .75" thick for the fireboard. Your fireboard must have a flat surface so it does not rock when placed on the ground. The length of your fireboard should be 1.5' to 2'. The holes in your fireboard should be .75" in from the edge. Make sure the hole is far enough from the edge to prevent breaking. To start the holes in your fireboard, use the sharp corner of a hand axe or a lock blade knife.

Your thunderhead should be made of a hard wood that has been taken from a log or branch. It should fit in the hand well and should be comfortable to the user. Start the hole in your thunderhead the same way you did in your fireboard.

The last part of your set is the bow. The bow should be about the length of your arm, or perhaps a little longer. It will work best if it is slightly flexible and has a slight curve. Unless your bow has a fork at the end(s), you will need to put notches or holes in your bow to keep the thong or rope from slipping. So, make sure your bow is thick enough. Do not forget to leave room for a handle. The thong or rope, which is used to turn the spindle on the fireboard, should be made of good quality rawhide or rope. Cherry sap may be used on the thong or rope to give the spindle a non-slipping surface.

Now it is time to burn the holes in your thunderhead and fireboard. Many methods can be used, but the most effective way has proven to be the type where the left foot is placed on the fireboard, the thunderhead is held under the knee of the left leg, and the bow is pumped with the right arm. If you are left-handed, you hold the fireboard with the right foot, the thunderhead is in the right hand, and you pump the bow with your left arm.

After you have burned the hole(s) into the fireboard, use a hand saw or a bow saw, and cut a narrow notch into the fireboard, so that the point of the V is at the center of the hole. The notch should go farther underneath the hole than it does on top so that the spark does not get caught. Use a knife to shave the rough edges, but remember not to make the notch too big.

So now are you ready to go for a spark? **NO!** You must first get your tinder ready for your fire. A bird nest without feathers or mud is the best tinder. Dry grapevine, sassafras, and the inner bark or cottonwood or aspen can be used, but should be shredded and made into a nest. Many people like dry grass which is easy to find, but make sure it is very, very dry! Dry grass also smokes a great deal. Make sure your nest has a place to put your spark. You will also need to have a fire lay built, because once lighted, your tinder will burn quickly. Also, you need at least one Firecrafter to be present to verify that you got the spark and sign the card.

Find the top of your spindle and make a notch near the top, or some other mark so you know which end is the top. This is very important, since you never want the top of the spindle to touch the fireboard, because this will lubricate the bottom of the spindle. Also, never touch the bottom end, as oil from your hands will lubricate it.

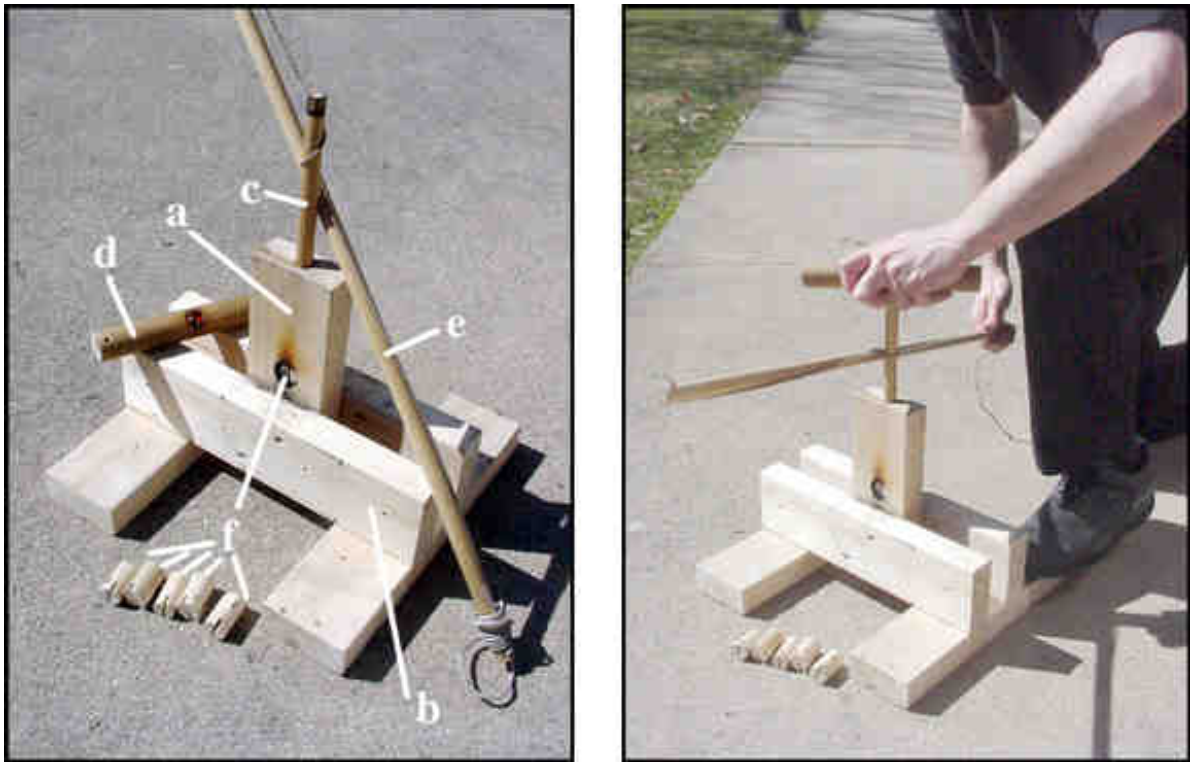
Now you are ready to get a spark. Put some jewelweed, sassafras leaves, or other natural lubricant inside the thunderhead. Tighten your bow before you start to pump, and tighten it again when necessary. Pump the bow in the manner described earlier. Take long, even strokes. Pressure is very important, so force as much weight as possible on to the thunderhead. Keep a good rhythm. A popular method is the 20-20-20. First take 20 long strokes to establish a good rhythm. Then, increase the speed for 20 strokes while adding a little pressure and maintaining long strokes. Finally, put on as much pressure as possible while going as fast as possible. If you can do this for another at least another 20 strokes, you probably will have a spark. Make sure you have something underneath your fireboard to catch your "goofers" dust and your spark. Aluminum foil works well for this. Keep all your goofers dust in a 35mm film cannister or something similar, as you will use it to build up your spark. Do not stop when smoke starts appearing. Add pressure and a little bit more speed. Even if you think you have a spark, keep pumping. When you feel like stopping, don't. If, after you stop pumping, smoke appears, you have a spark.

Once a spark is obtained, fan it with a knife blade. Catch your breath, and get your nest ready. You should not be in a hurry. After the spark has been built up with the goofers dust you have saved up, cut it in half and place it into the middle of your nest with your knife blade. Enclose the spark with the nest, but do not smother it. Hold up the nest as if you were praying to something in the sky, and whisper to that beautiful spark. If you blow too hard, you will blow it out. As the spark gets larger and more abundant, blow a little harder. Soon the tinder will burst into flames, but do not drop the nest. Instead, place it down into the fire lay that you have built. If the first half of your spark does not light the tinder, use the other half that remains from when you cut the spark, and place it in the birds' nest again. Build up your fire, as it has to keep going for fifteen minutes. **Do not use your set for firewood!**

You need to start building your set early in the week, and try to have it finished by Tuesday evening. Remember, protect your fire-by-friction set and never get it wet. Keep it covered from dew and moisture at all times. Building a fire by friction set is fun and exciting, but the actual making of a fire with your own set gives you a feeling of great accomplishment and achievement. If you believe you can do it, you should not have much of a problem.

Few people in the twenty-first century remember how to make fire, to really make fire, from scratch, as it were. If you are to make the long journey from caveman[1] to chemist, you must learn this skill, which precedes all others. To make fire you need wood and air, both of which are easy to come by, but the central problem of fire-starting is getting enough heat to initiate the combustion of charcoal. The easiest, though least convenient solution, is to simply wait for a lightning strike as the original Lucifer did. Once people began making stone tools, it became apparent that certain stones sparked when struck together, and that if you caught the spark in a flammable material, you could start a fire. The modern cigarette lighter is the child of this technology. In addition to stone, wood itself was used for making tools, though it leaves little evidence in the archeological record. When wood is rubbed together, the friction generates heat, sometimes enough heat to ignite the wood. The modern friction match is based on this phenomenon. With the invention of the glass lens in the fifteenth century, fire could be started by focusing the light of the Sun on a combustible material, a technology that has delighted children and terrified ants ever since.

**Figure 1-4. The Fire Kit**




None of the ancient methods of fire-making are easy to learn, and all of the modern methods are so easy as to be trivial. For this book, I wanted a method which would be easy enough for most people to master, while preserving some of the challenge of traditional methods. Flint and steel is not too demanding but it requires steel, which was unknown in Paleolithic times. The magnifying glass, though entertaining, is also too recent a development for our purposes. This leaves fire by friction, the method I have chosen for consideration. One of the most popular tools for making

fire by friction is the bow-drill. Reliable, portable and quick, it has remained my favorite method over the years, but like learning to ride a bicycle, it requires practice. To facilitate this practice I have devised "training wheels," as it were, for the bow-drill.

Figure 1-4(L) shows the complete fire kit. A brief overview of its parts and operation will be given first, with details to follow. The "training wheels" consist of the guide (a) and supports (b), all cut from standard 2x4 inch[2] lumber. The guide is 9 inches tall and has two holes drilled at right angles to one another. The vertical hole is 5/8 inches in diameter and approximately 4 inches deep. The horizontal hole is 1 inch in diameter and goes completely through the guide. The holes must be drilled so that they intersect one another, that is, so that you may look down through the vertical hole into the horizontal one. The four supports are 14 inches long and must be screwed or pegged to the guide and to one other so that they securely hold the guide upright.

The vertical hole in the guide accommodates the spindle, (c), a 9-inch length of 5/8-inch diameter hardwood dowel rod. Such rod can be purchased inexpensively at hardware stores and craft shops. Since the spindle will be gradually consumed, you should have several of them on hand. The spindle should turn freely; if it sticks, enlarge the vertical hole with sandpaper until the spindle is free to turn. The top of the spindle will be held by a block, (d), a piece of wood with a shallow hole large enough to hold the spindle without binding. To keep from burning through the block, this hole should be drilled large enough to snugly fit a half-inch copper "endcap," available wherever plumbing supplies are sold. The inside of this endcap should be lubricated with fat or oil so that downward pressure may be applied to the spindle as it turns. In addition to the spindle and block, you will need a bow, (e).

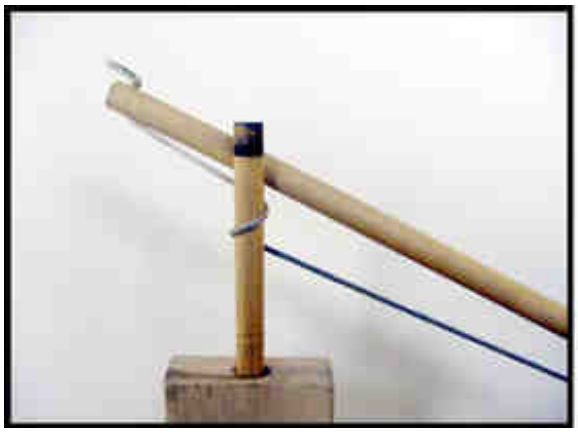
It is not necessary that the bow be either flexible or curved. In fact, a 3-foot length of 5/8-inch diameter dowel rod will work admirably. Your bow will need a bow-string, for which a 6-foot length of 1/8-inch diameter nylon cord will serve. The bow needs one hole at each end large enough to accommodate the nylon cord. The cord is knotted at one end, passes through both holes in the bow, and is simply wrapped around the bow at the other end, allowing the tension of the bow-string to be adjusted. The bow-string will be wrapped around the spindle in such a way that motion of the bow turns the spindle.

Figure 1-4 shows the fire kit in operation. The left foot is placed on the support with the shin parallel to the guide. The left hand,[3] braced against the knee, grips the lubricated block and applies downward pressure on the spindle. The bow is held parallel to the ground with the right hand and as it moves back and forth, the spindle turns freely in the guide. The lower end of the spindle presses against a piece of wood, the fire-board, which sits in the 1-inch hole in the guide. It is friction of the spindle against the fire-board which will produce the heat needed for our fire.

**Figure 1-5. Yucca and Mullein**

Not just any wood will work for the fire-board; it needs to combine strength, flammability, and low density. If you choose the wrong wood, your path will be filled with nothing but frustration. When looking for fire-board materials, low-density wood is best, as its low thermal conductivity allows heat to build up faster than it can be carried off. Think balsa, not mahogany. I have found yucca, shown in Figure 1-5(L), to be an excellent choice, and it is commonly available throughout North America as an ornamental plant. It can be recognized by its tuft of leaves at the base, its stalks reaching for the sky, and its fist-shaped fruits. Harvest the stalks in the fall, after the fruits have fallen. Mullein, shown in Figure 1-5(R), is another wood suitable for the fire-board. Strip off the leaves and let the stalk dry. Whichever wood you choose, cut it into short lengths that will fit into the 1-inch hole in the guide.

**Figure 1-6. The Bow**



Now that the overview is complete, let us look at some details, starting with the bow. Figure 1-6(L) shows the far end of the bow, where the bow-string is knotted. The bow-string passes through a hole in the bow and is wrapped once around the spindle in the direction shown; if the bow-string is wrapped in the wrong direction, it may bind. The bow-string passes from the spindle through the hole in the near end of the bow. With the bow at an acute angle to the ground, the bow-string is pulled as tight as possible and then wrapped around the bow, forming a handle, as shown in Figure 1-6(R). Wrapping the bow-string rather than knotting it allows its tension to be re-adjusted quickly. When the bow is brought parallel to the ground the bow-string will come under tension, gripping the spindle tightly.

**Figure 1-7. The Spindle and the Fire-board**

Figure 1-7(L) shows the "business end" of the spindle, the end which contacts the fire-board. A fresh spindle will be white and its end flat, but as it is used the end will char and assume a conical shape. Several fire-boards may need to be consumed before this ideal condition is established. Figure 1-7(R) shows details of the fire-board, with a notch, or chimney, cut into the end and a hole burned into the top by friction with the spindle. This particular fire-board has already made a fire and consequently its hole is relatively deep. I pre-notch my fire-boards and place them into the guide so that the tip of the spindle is near the vertical chimney. As the spindle burns a hole in the fire-board, charred wood dust, or punk, spills out of the chimney. It is this hot punk which will give birth to the ember.

**Figure 1-8. A Star Is Born**

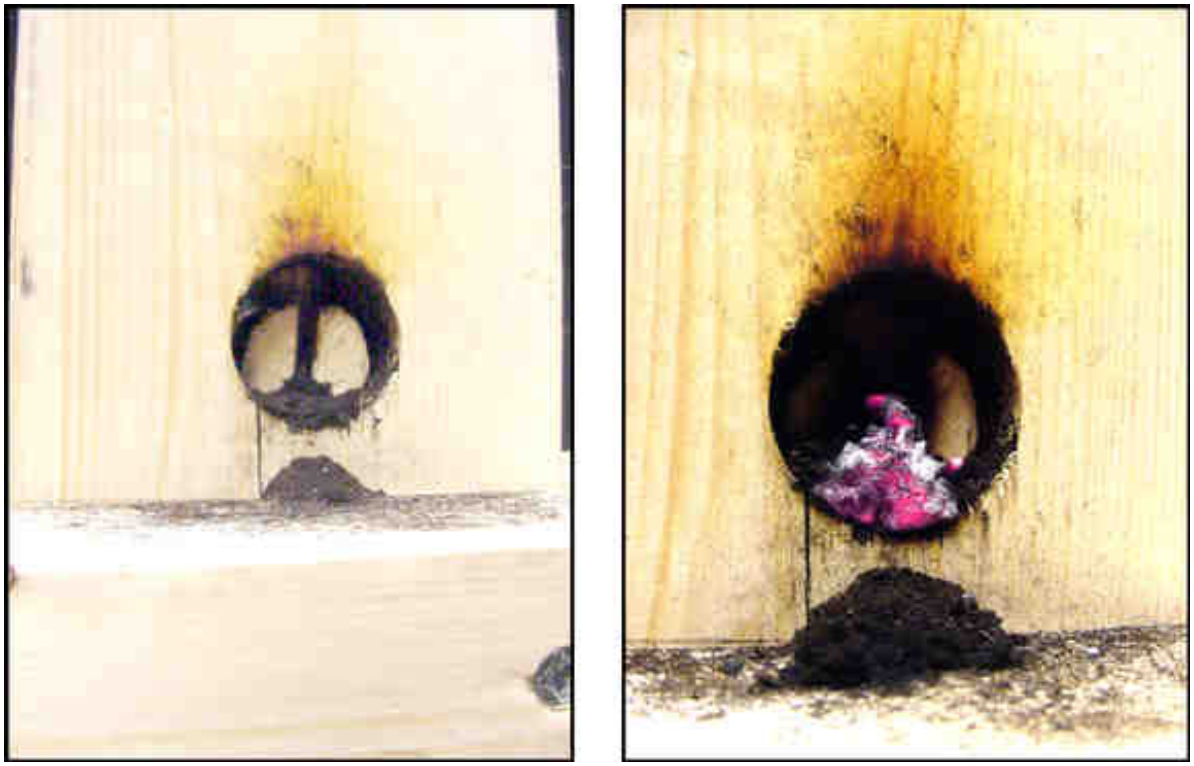


Figure 1-8 shows the fire-board with its chimney in the guide. As the bow turns the spindle and pressure is applied with the block, the fire-board will begin to smoke and punk will spill from the chimney. If the pressure from the block is too light, no smoke will appear; if it is too heavy, the spindle will burn all the way through the fire-board before the punk catches fire. Therefore heavy pressure may be applied until smoke appears and then only enough pressure to maintain a thick, heavy smoke. The optimal bowing technique is to use long, smooth, steady strokes rather than short, rapid ones. Two or three strokes per second are quite sufficient. Try to make the pushing stroke with the same speed and pressure as the pulling stroke. The bow should move parallel to the ground and alongside your hips, rather than into your stomach. If you manage the block and bow gently and with great skill, the smoke will become thicker and thicker until the pile of punk itself begins to smoke. When this happens, stop bowing and blow on the hot punk; if blowing on it increases the amount of smoke, the punk very likely contains an ember. Keep blowing until the ember appears, as shown in Figure 1-8(R). A natural Lucifer may get an ember from the very first fire-board, but most people will go through two or three of them before achieving success. Once you have learned to make fire with the guide, you can try doing it au naturale; the guide will have trained you in the proper technique.